# Circuit Simulation Project

https://esim.fossee.in/circuit-simulation-project

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**Title of the circuit:** Design and Simulation of Single-Phase Full Bridge Inverter with RL Load

Theory:

A single-phase full bridge inverter is a power electronic circuit that converts DC power into AC power. It is widely used in various applications, such as uninterruptible power supplies (UPS), motor drives, and renewable energy systems. The full bridge inverter consists of four switches, typically MOSFETs or IGBTs, arranged in a bridge configuration. The RL load, consisting of a resistor and an inductor in series, represents the typical load connected to the inverter output.

The output voltage waveform of the full bridge inverter is a square wave. However, due to the presence of the inductor in the RL load, the output current waveform is not a perfect square wave. The inductor opposes the change in current, causing the current to rise and fall gradually. This results in a smoother current waveform with a trapezoidal shape.

The RL load has a significant impact on the performance of the full bridge inverter. The inductor causes the output current to lag behind the output voltage, resulting in a phase shift between the two waveforms. This phase shift can affect the power factor of the inverter and reduce its efficiency.

The operation of the single-phase full bridge inverter can be divided into two modes:

- Mode 1: Switches S1 and S2 are closed, while S3 and S4 are open. This connects the load to the positive terminal of the DC source, resulting in a positive output voltage.
- Mode 2: Switches S3 and S4 are closed, while S1 and S2 are open. This connects the load to the negative terminal of the DC source, resulting in a negative output voltage.

By alternately switching between these two modes, an AC voltage waveform is generated across the load. The frequency of the output voltage is determined by the switching frequency of the switches.

1. Schematic Diagram :

The circuit schematic of Single-Phase Full Bridge Inverter with RL in eSim is as shown below:

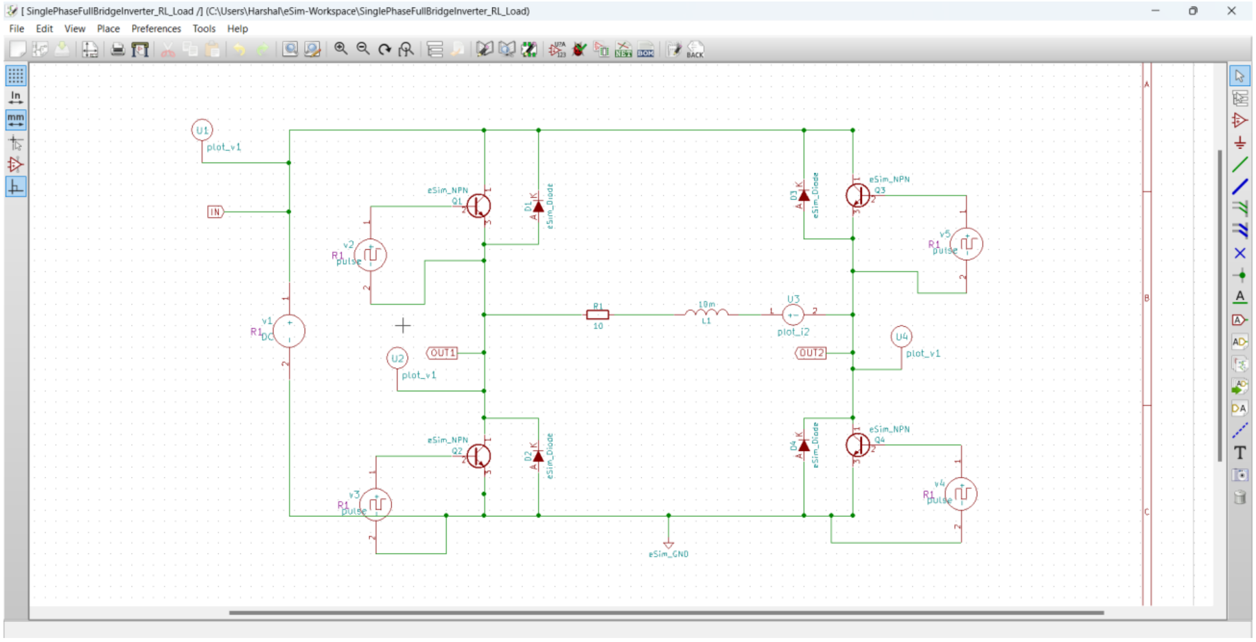
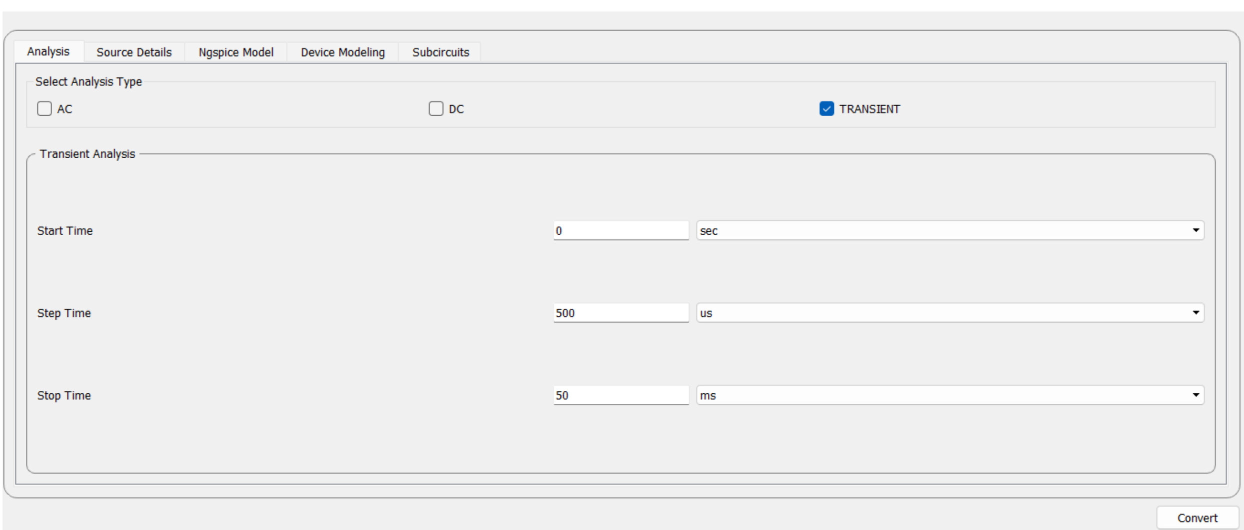
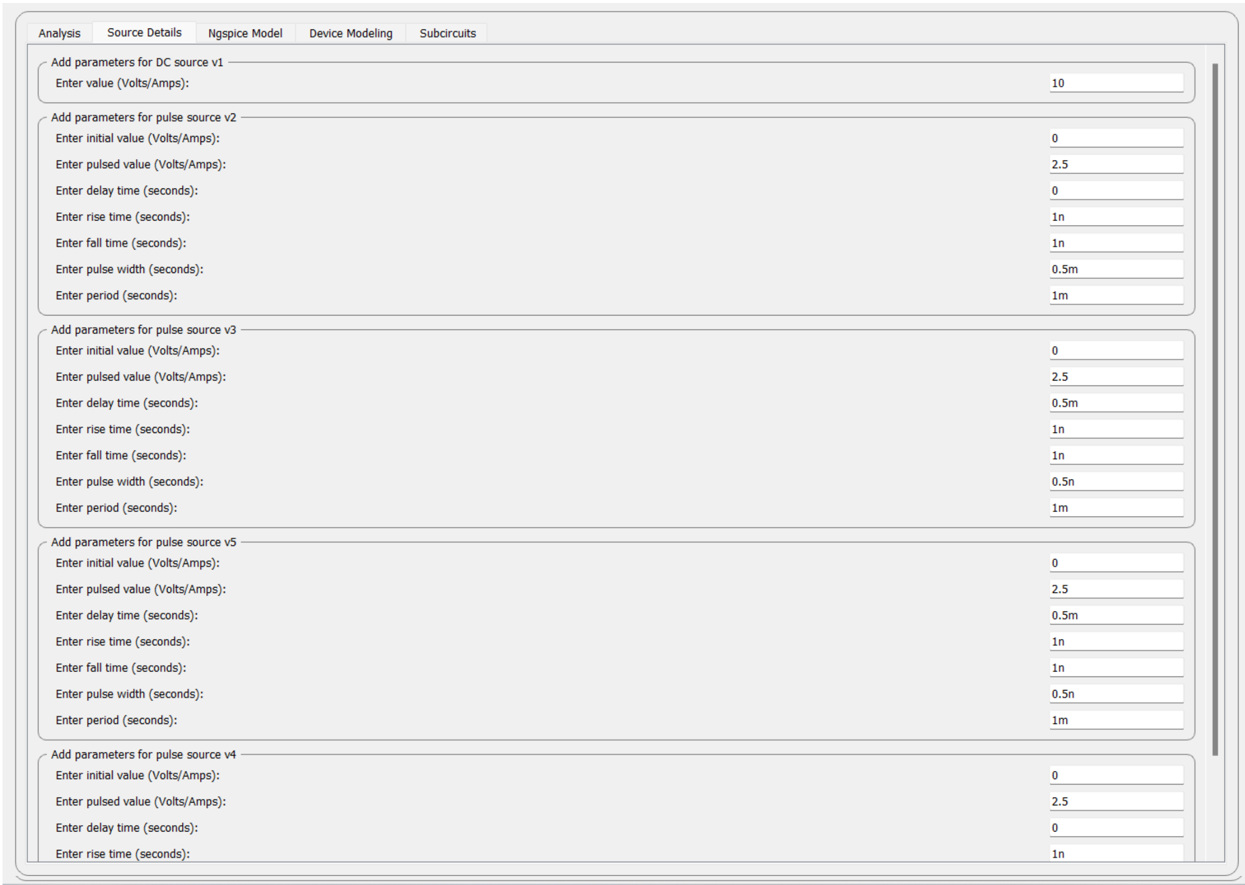



Figure 1: Circuit schematic Single-Phase Full Bridge Inverter with RL

2. Transient Analysis Parameter are as below:





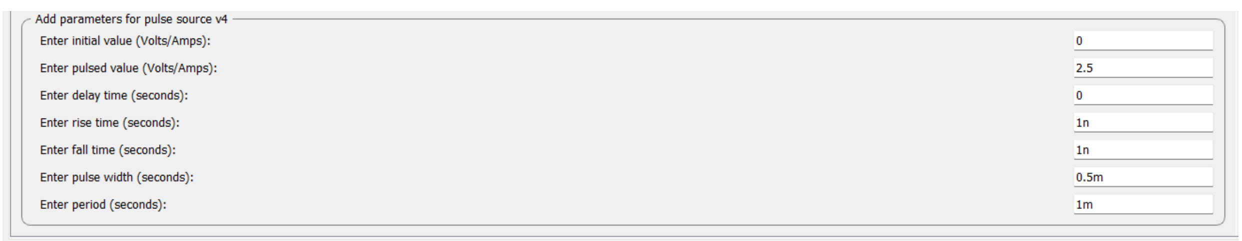




Figure 2: DC Source V1, V2 , V3 , V4 and V5

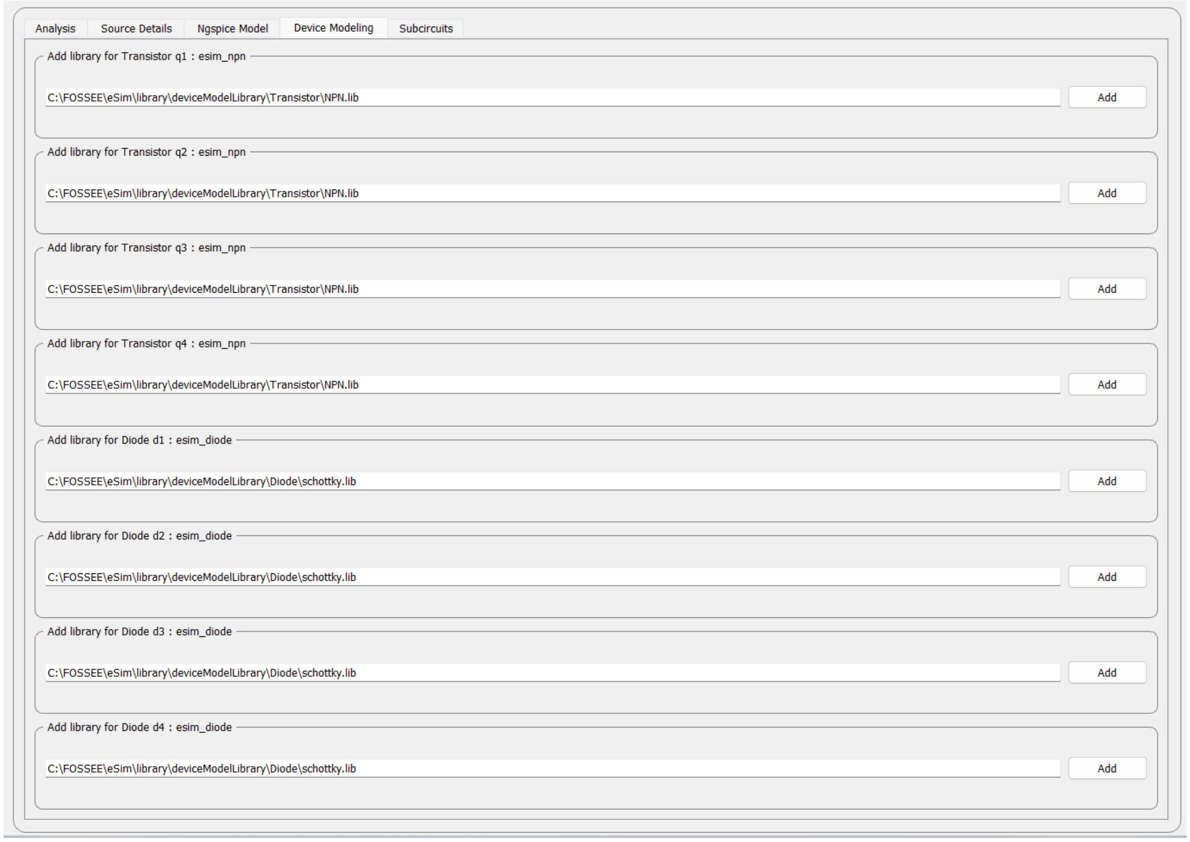



Figure 3 : Device Modeling of circuit

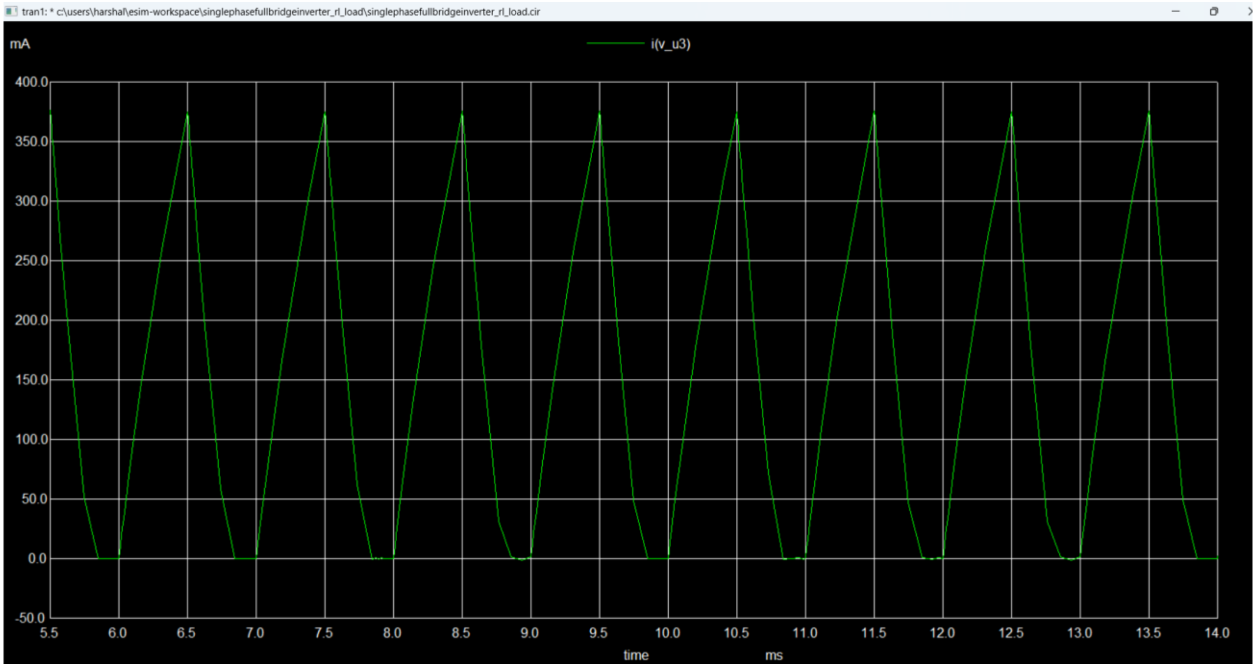



Figure 4: Ngspice Input Voltage Plot

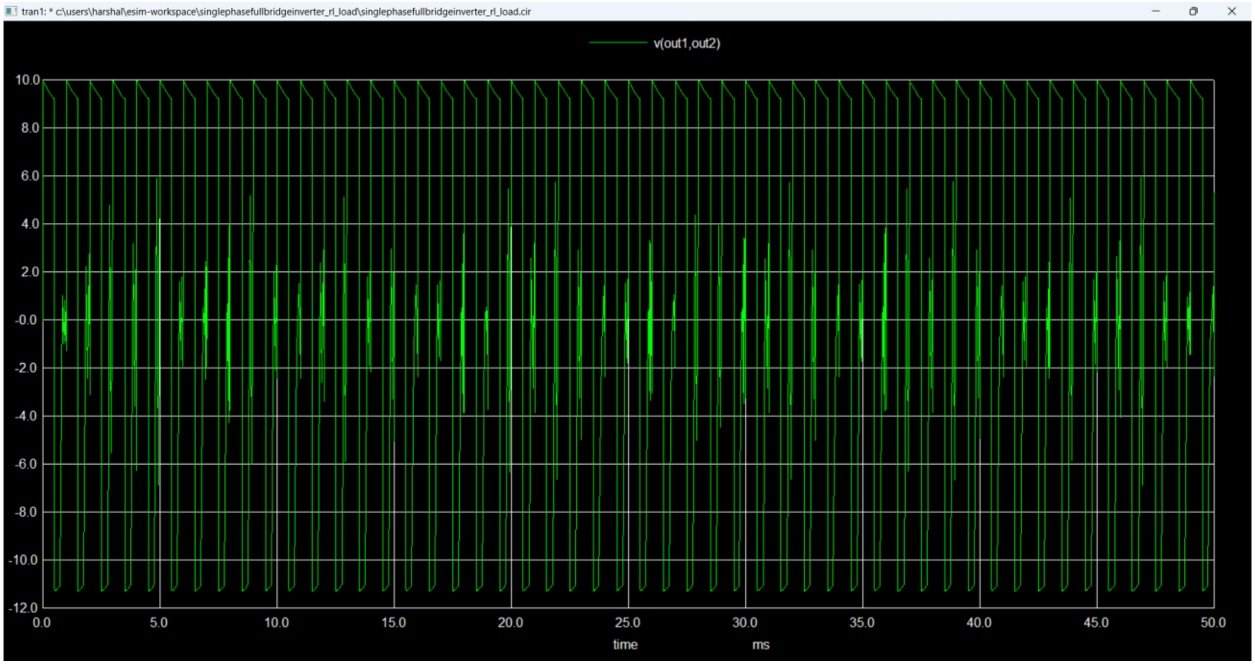



Figure 5 : Ngspice Output Voltage Plot

## Python Plotting:

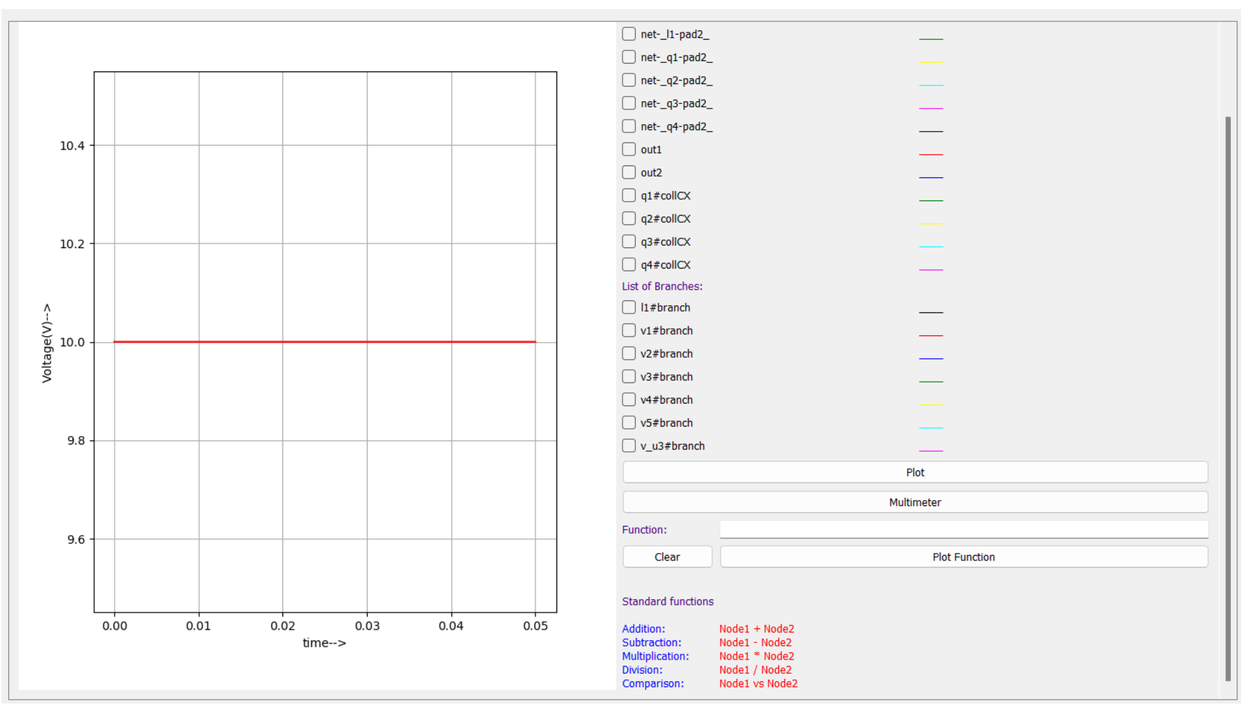



Figure 6: Input Voltage Python Plot

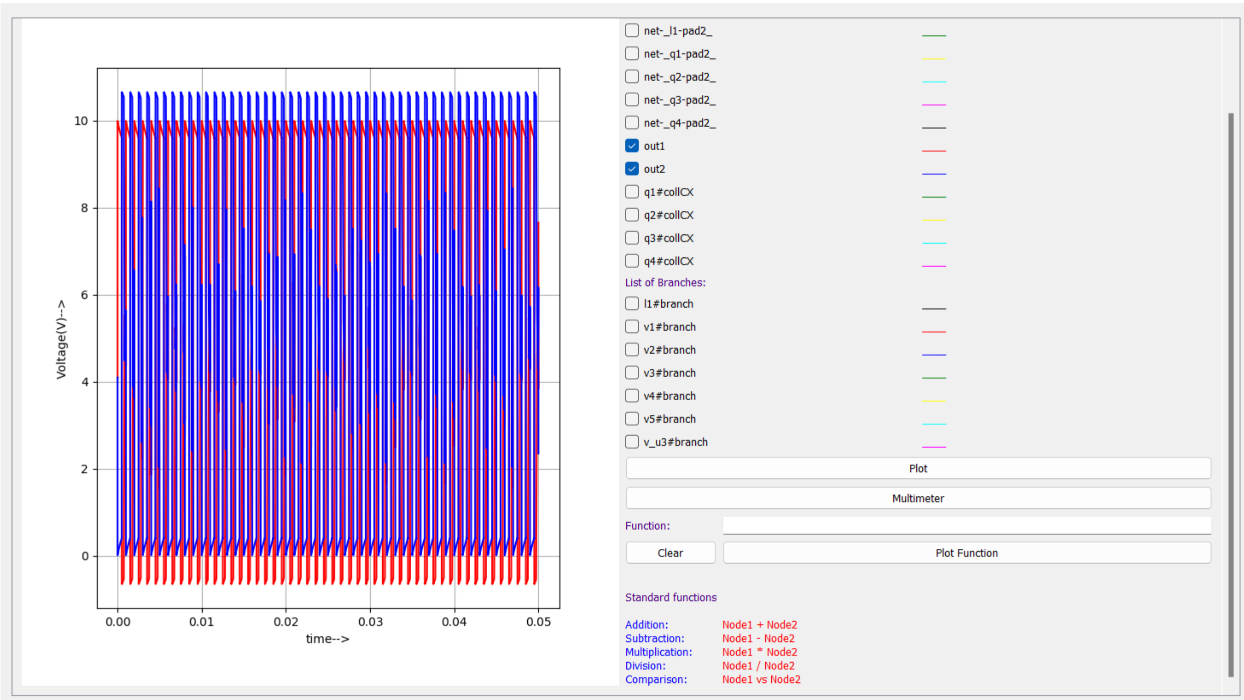



Figure 7: Output Voltage Python Plot

Conclusion: The single-phase full bridge inverter is a versatile and efficient power electronic circuit that is widely used in various applications. Its ability to convert DC power into AC power with a high degree of control makes it an essential component in many modern electronic systems.

## References:

Power Electronics (M D Singh & K B Khanchandani) 2nd Edition (Page No. 545)
Power Electronics by Dr. P.S. Bimbra (Page No. 311,312)